One Sample t-test: Special Case:

Matched Pairs Design → mean difference

- How many samples?

  2 samples → "combine" into 1 sample of differences

- What type of design?

  comparative design

- Most common types of problems:
  - 1st group / 2nd group
  - * Before / After
    - always after - before

      $\mu > 0$ $\mu < 0$

- Can also be...

2 subjects matched Ex: twins, couples

* lurking vars.

- Two sets of data must be...

dependent on each other

- How do we compare the 2 sets of data?
  - look @ differences (subtraction)

matched pairs - often reduce lurking vars.

- Once we have the differences...
  - We use... one sample t procedures
  - Test... avg. difference
    mean difference
  - How do we write this in the hypotheses?

$H_0: \mu_d = \#$

$H_a: \mu_d \neq \#$

*often $H_0: \mu = 0$

- Conclusion:
  - fail to reject / reject....
  - sufficient evid. that the mean difference of/btw. _____ is $\geq$ $\leq$ # _____ units.
- Assumptions:
  - dependent SRS
  - normal pop of differences
    or
    $n_d \geq 30$

Example #1:

The SAT prep course here at CB south claims to increase the SAT math scores of its students by 30 points. We don't think it is this much. We think it is less. We measure 5 students' SAT math scores before and after taking the class and find the following data. Test the hypotheses.

Subject	Before	After	diff
A	500	520	20
B	430	440	10
C	490	480	-10
D	550	590	40
E	520	550	30

$H_0: \mu_d = 30$

$H_a: \mu_d < 30$

$$t = \frac{\bar{x}_d - \mu_d}{s_d/\sqrt{n_d}} = -1.395$$

$P(t < -1.395 \mid df = 4) = 0.1177$

- fail to reject b/c p-val of 0.1177 > α = 0.05
- we have suff. evid. that the avg. diff. btw. scores before & after SAT course is equal to 30 pts.

Example #2:
We want to test the differences between Mrs. Tannery's (CB East teacher) Block 2 and Block 4 SAT prep classes. Mrs. Tannery thinks that she taught Block 2 better than Block 4. Using the data below, test the hypotheses. The data gives the average class score for each of the 9 weeks of the course.

before after

Date	Block 2	Block 4
10-Sep	480	472
17-Sep	497	495
24-Sep	505	502
1-Oct	499	524
8-Oct	517	515
15-Oct	524	530
22-Oct	552	531
29-Oct	540	531
5-Nov	583	574

$$t = \frac{\bar{X} - \mu}{s/\sqrt{n}} = -0.605$$

$P(t < -0.605 \mid df = 8) = 0.2811$

$H_0: \mu_d = 0$
$H_a: \mu_d < 0$

- fail to reject
- suff. evid. that the avg. diff. btw Block 2 & Block 4 is equal to 0 pts.
- Therefore Mrs. Tannery teaches both classes equally

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(a) $H_0: \mu_d = 0$

$H_a: \mu_d \neq 0$

(b) $t = \dfrac{\bar{x}_d - \mu_d}{s_d/\sqrt{n_d}} = 12.8233$

$2 \cdot P(t > 12.8233 \mid df = 4) = 0.0002$

(c) $\bar{x} \pm t^* s/\sqrt{n} = (0.40, 0.56)$

We are 90% conf. that the avg. diff. btw. tires A & B is btw. 0.40 and 0.56 miles.